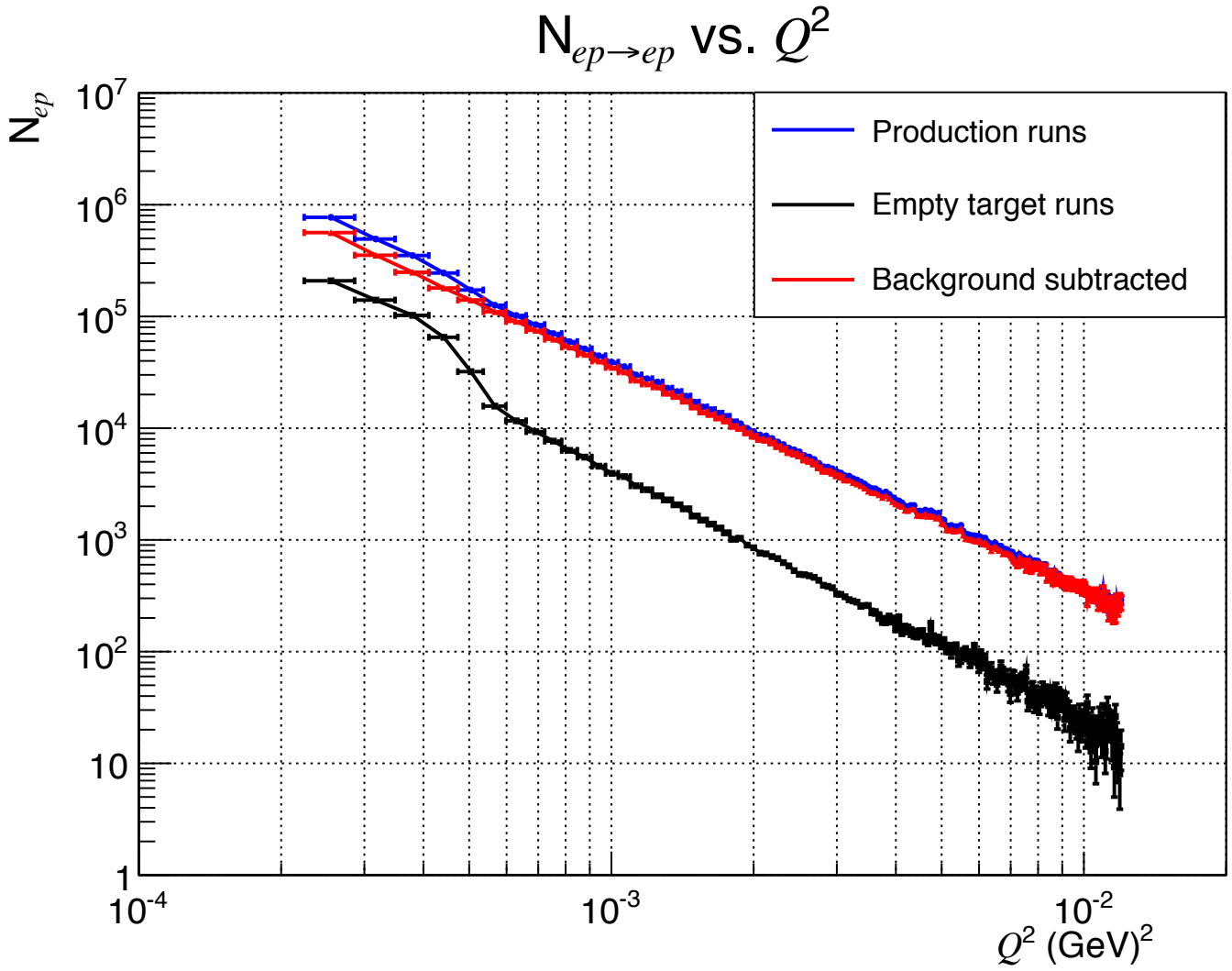
Stability of ep to ee2 Ratio

- For ep, background from residual gas and beam line contribute to at least 10% of the yield (~30% at theta < 1.2 deg)

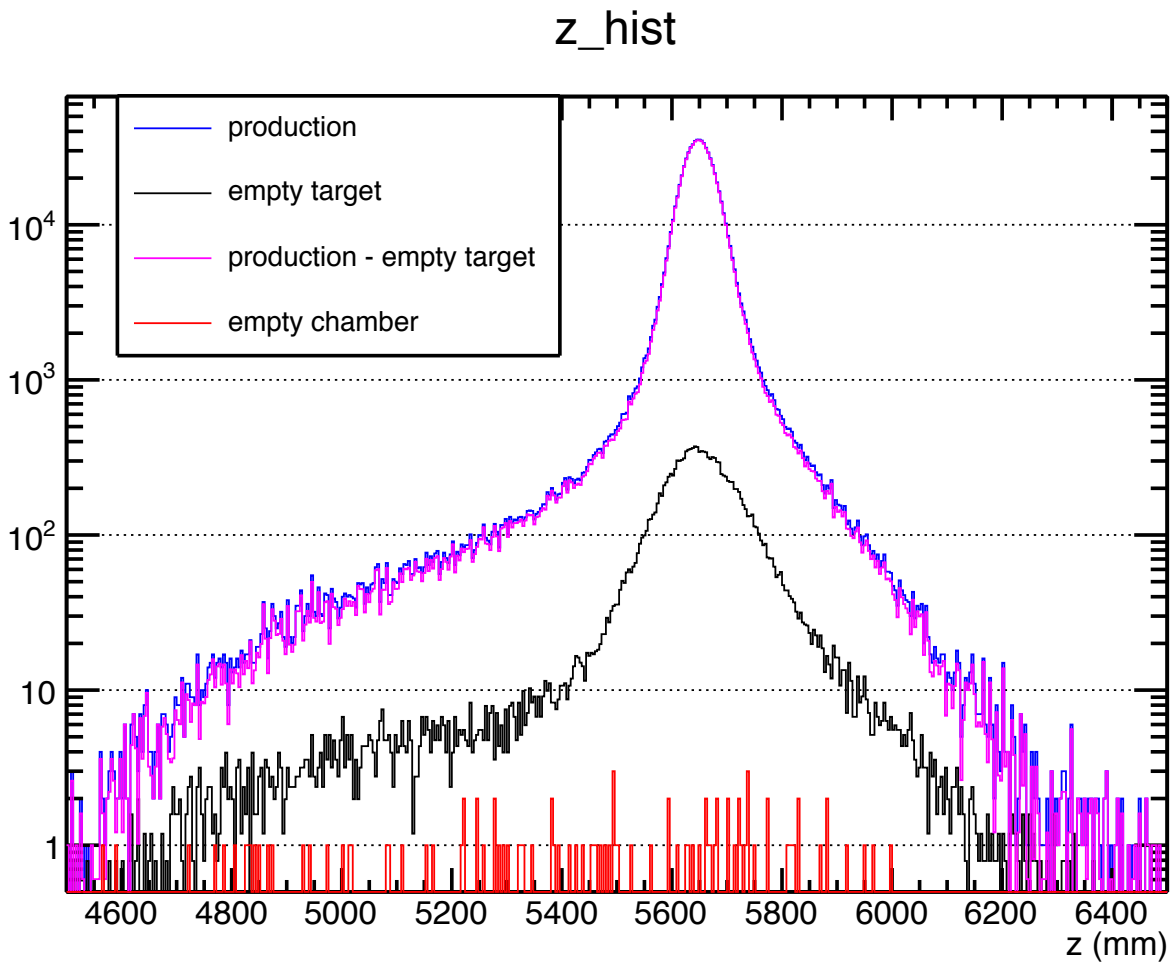
- For double arm Moller, the contribution is less than 2%

- The live charge weighted double arm Moller yield has a fluctuation of about +/-15%

- So if the background is not subtracted clean for ep, there will be a ~ ~<3% fluctuation in the ratio

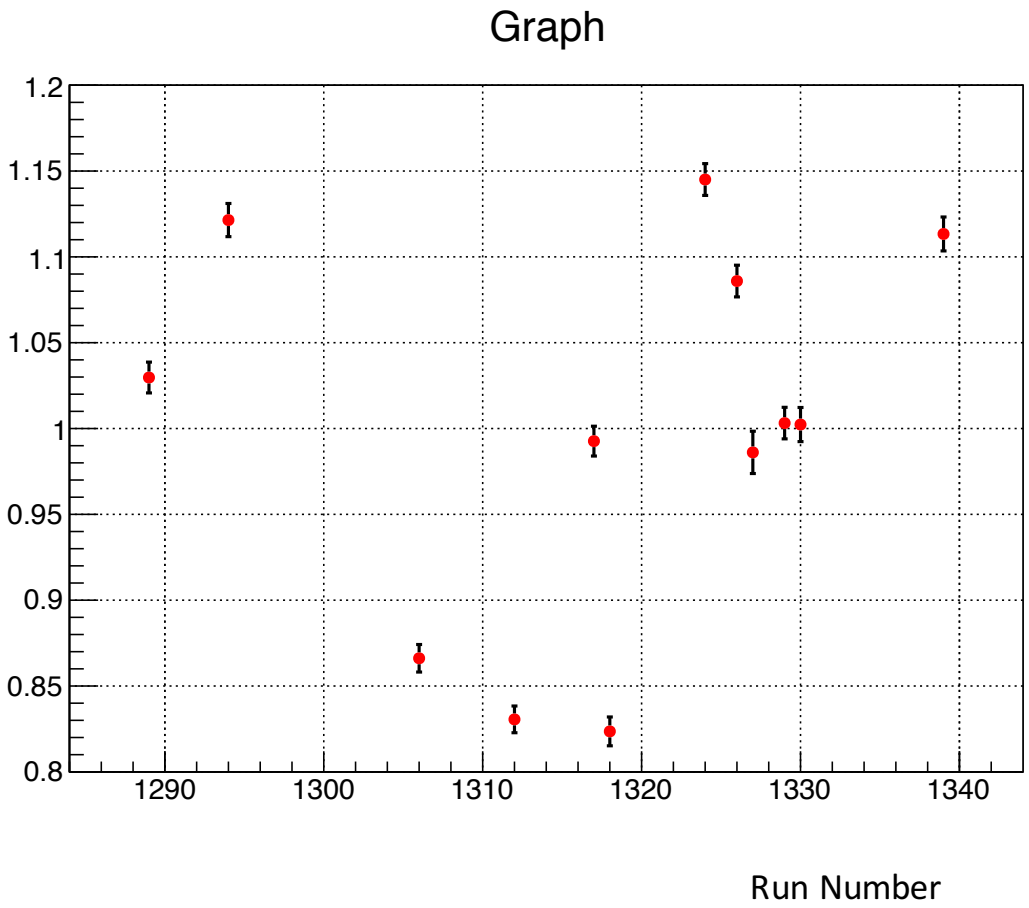

$N_{ep\to ep}$ vs. Q^2
N_{ep}
10^7
10^6
10^5
10^4
10^3
10^2
10
1
10^{-4}
10^{-3}
10^{-2}
Q^2 (GeV)^2
Production runs
Empty target runs
Background subtracted

Distance between Projection Plane and Vertex Z

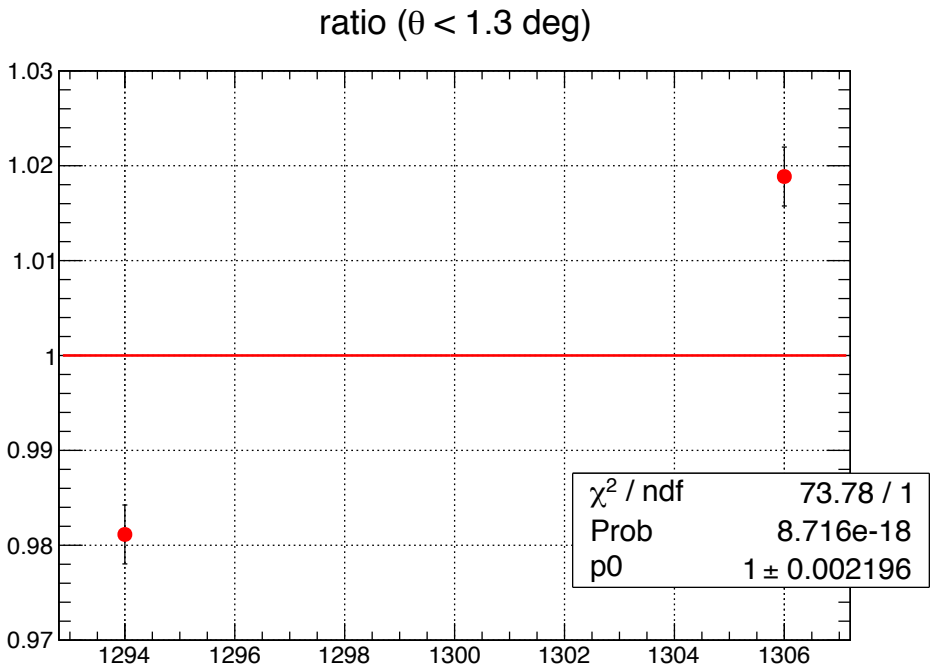


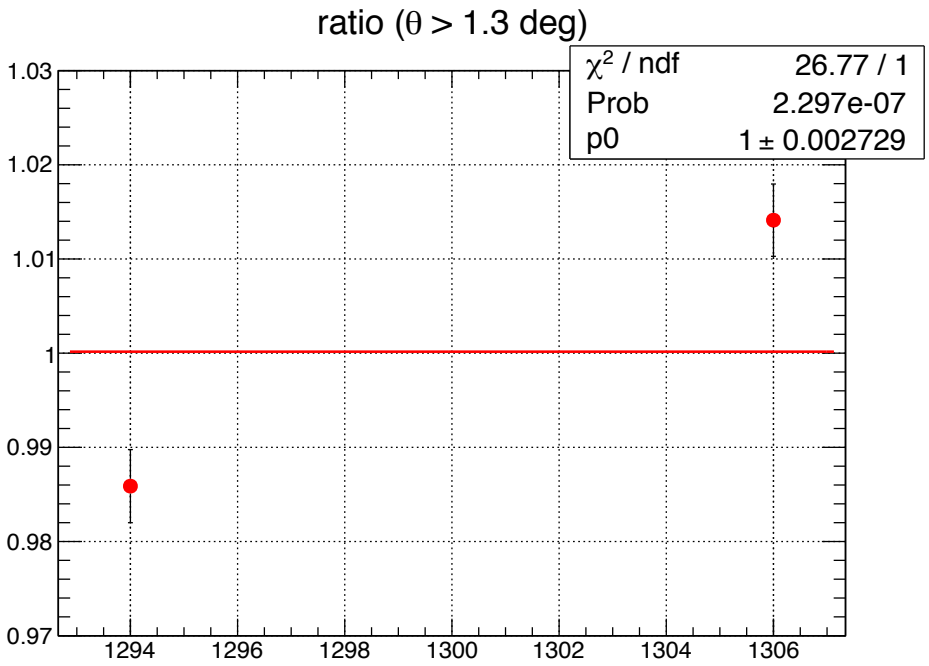
Live charge weighed double arm Moller yield from empty target

- Normalized and live charge weighted double arm Moller background from empty target run
- Each point is the integrated yield from 0.8 to 3.4 deg, normalized to be average value of all data points
- The two factors contribute to this fluctuation:
  - Live charge
  - Target thickness of residual gas
- Such large fluctuation is not observed in yield from neighboring production runs (0.98~1.04)



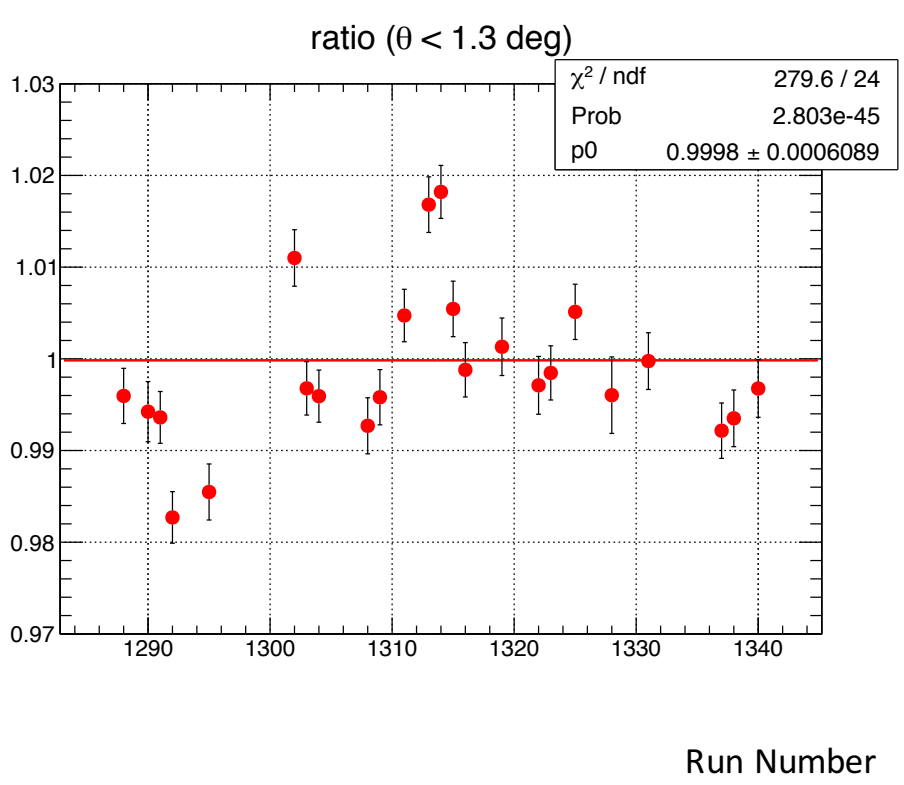
Ratio of ep / ee2, after background subtraction using empty target run 1294 or 1306

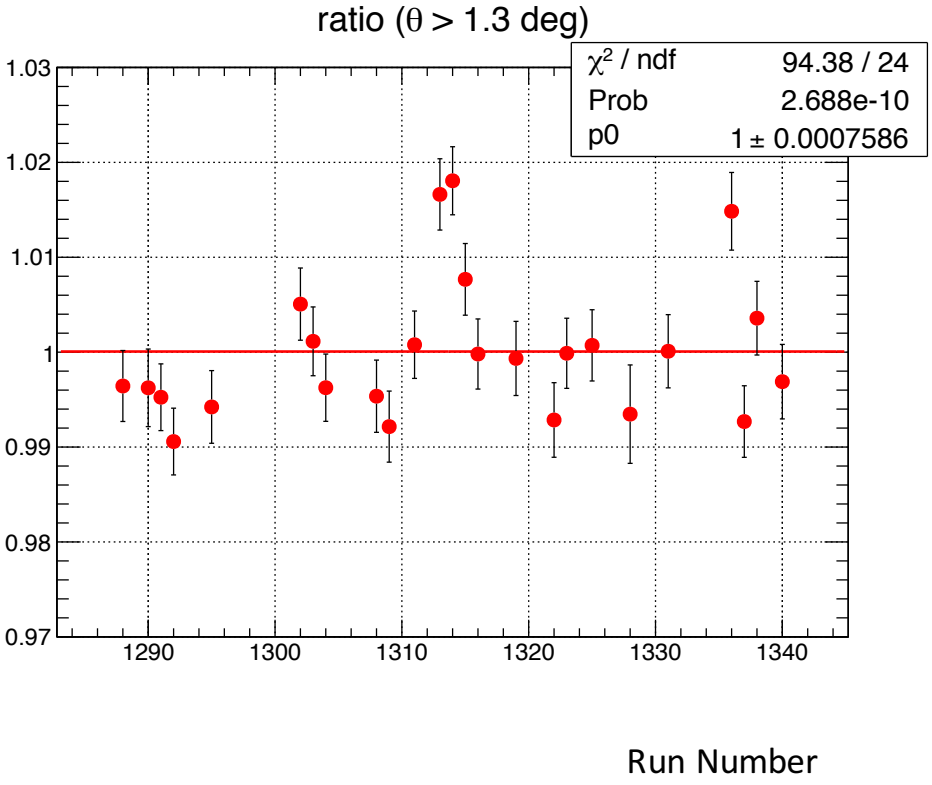




Stability of ep to ee2 ratio

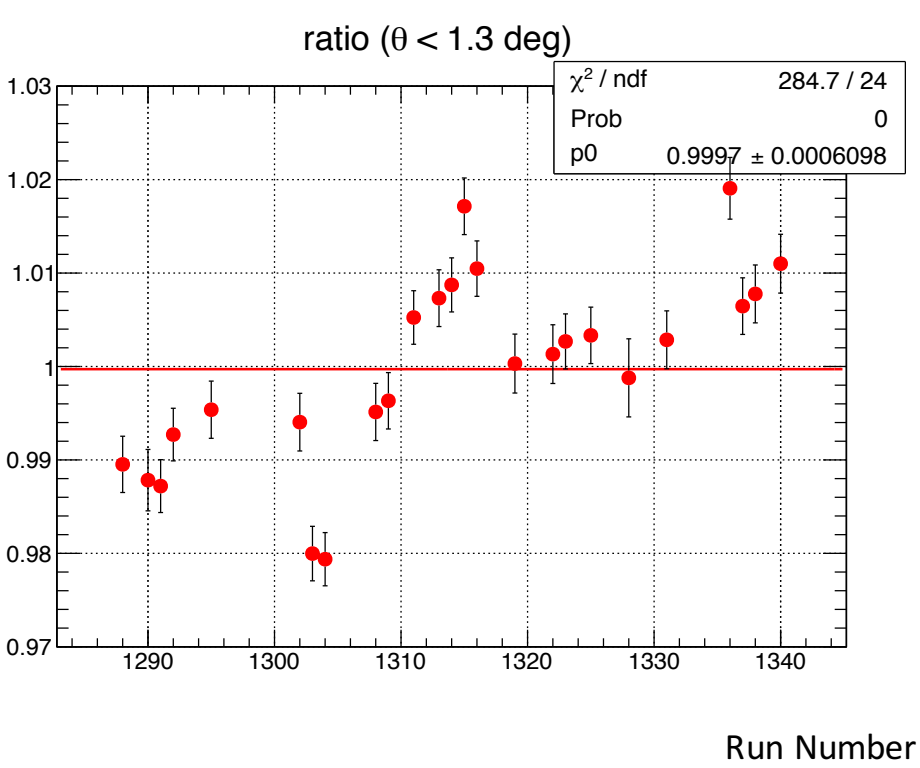
For each production run, using only the nearest empty target run

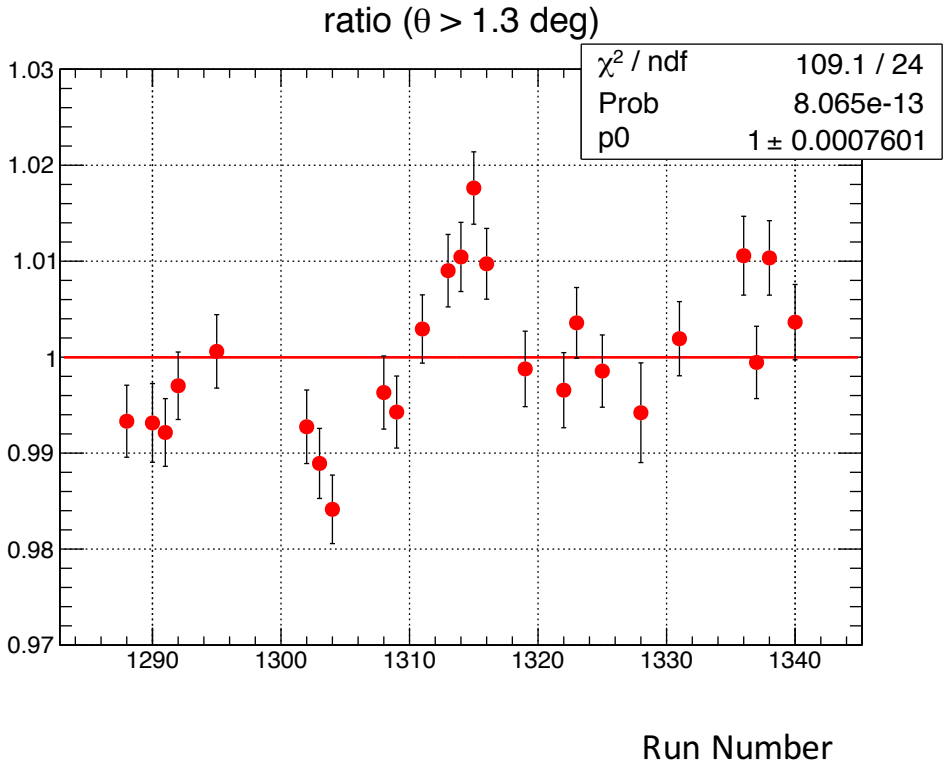




Stability of ep to ee2 ratio

For each production run, using two nearest empty target run

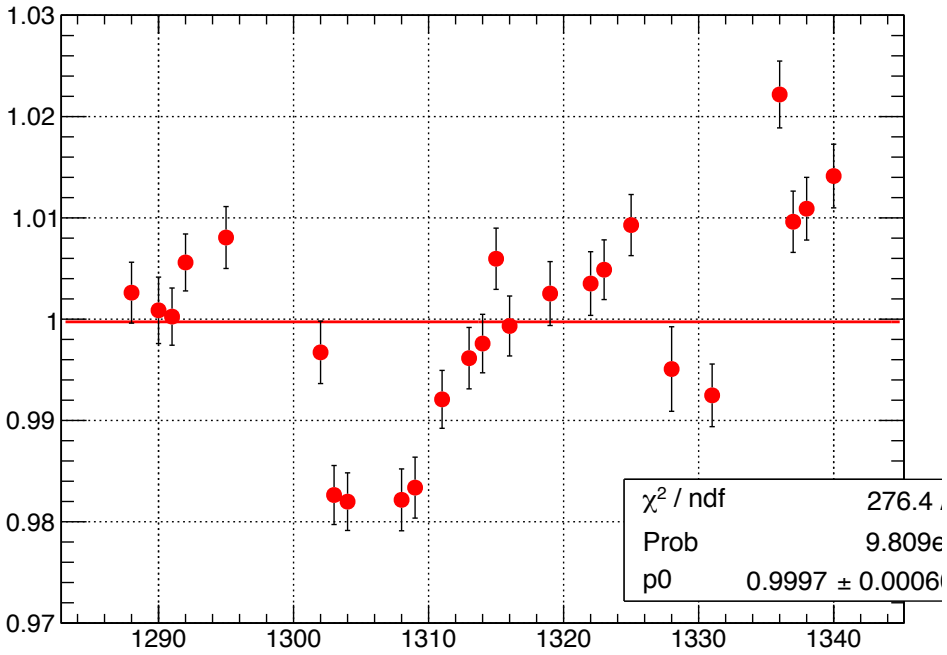




Stability of ep to ee2 ratio

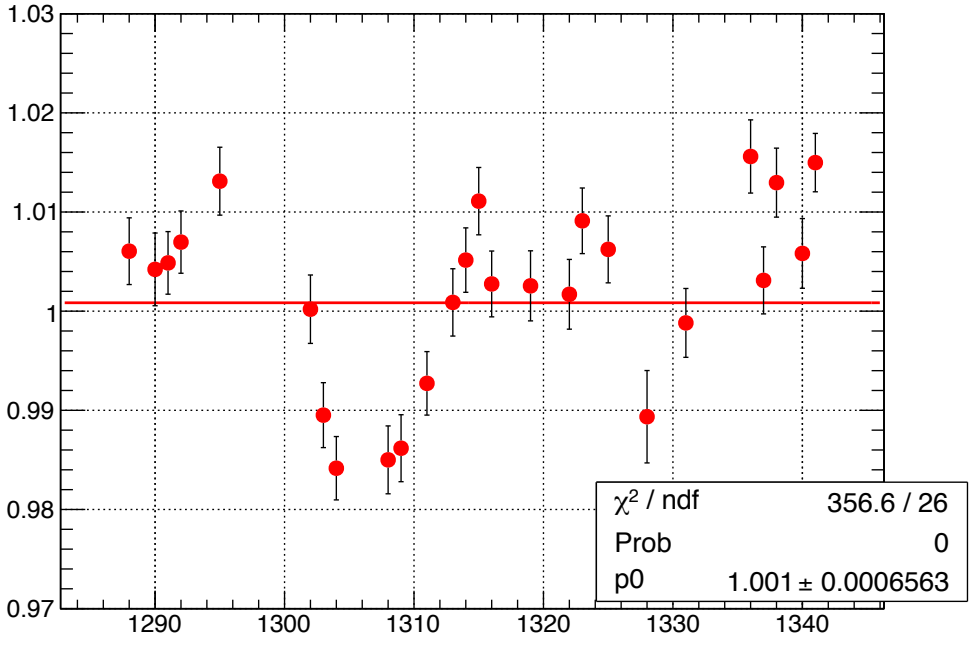
For each production run, using four nearest empty target run

ratio ($\theta < 1.3$ deg)



Run Number

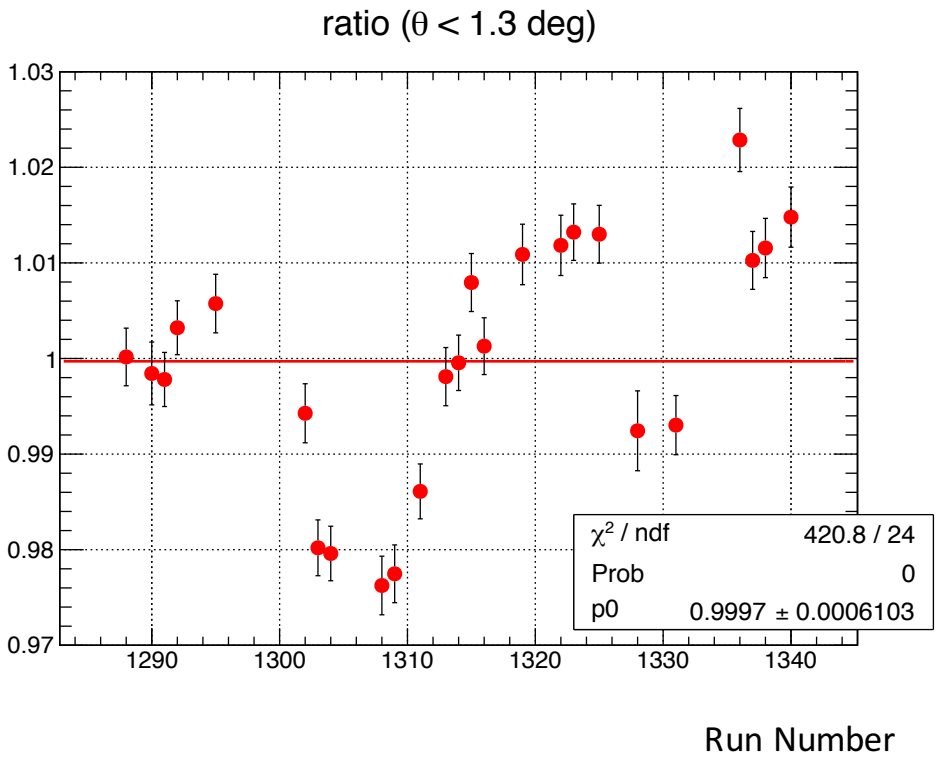
ratio ($\theta > 1.2$ deg)

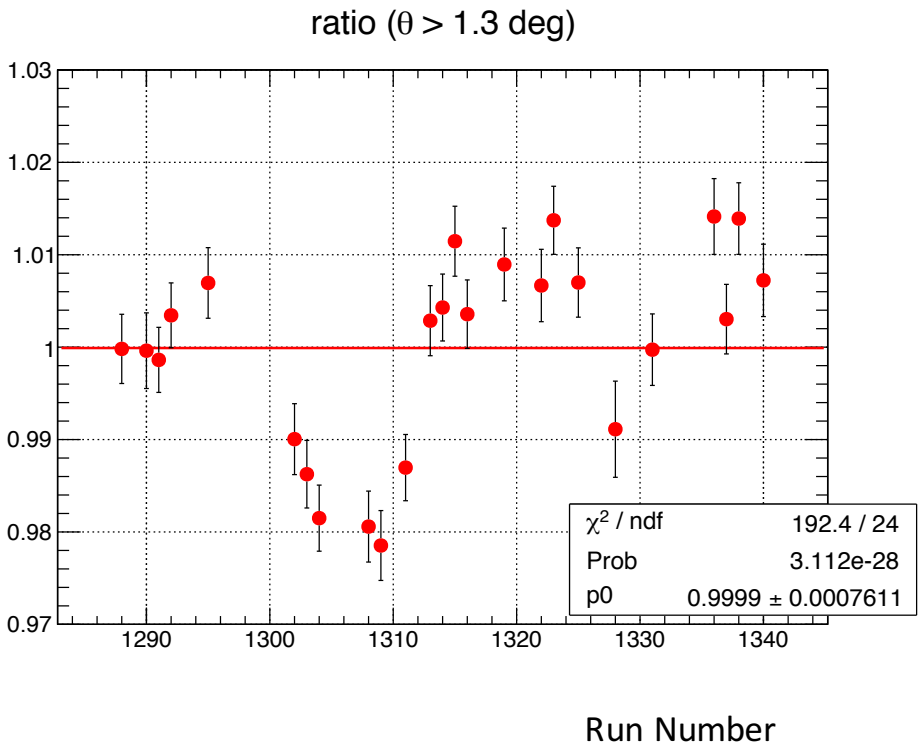


Run Number

Stability of ep to ee2 ratio

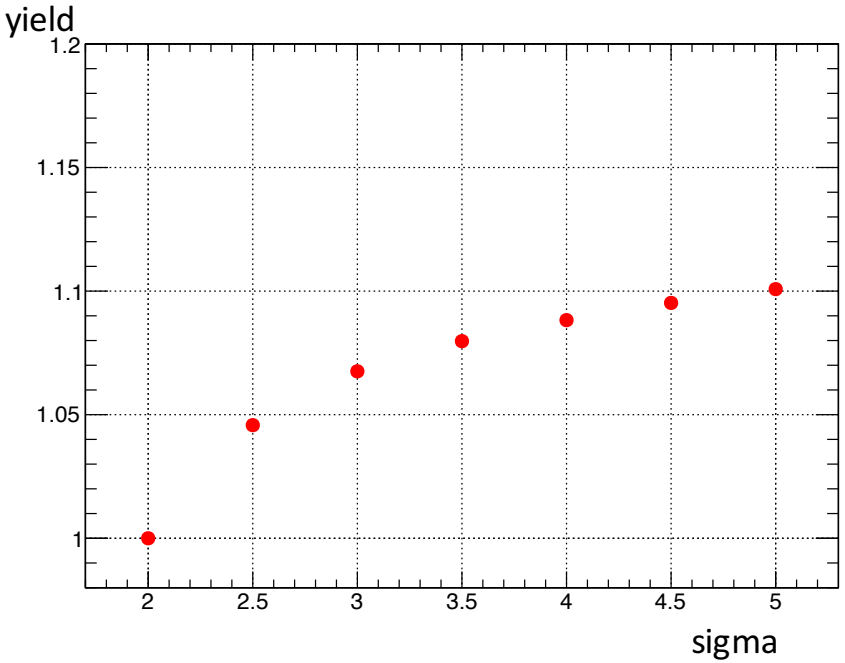
For each production run, using all empty target runs

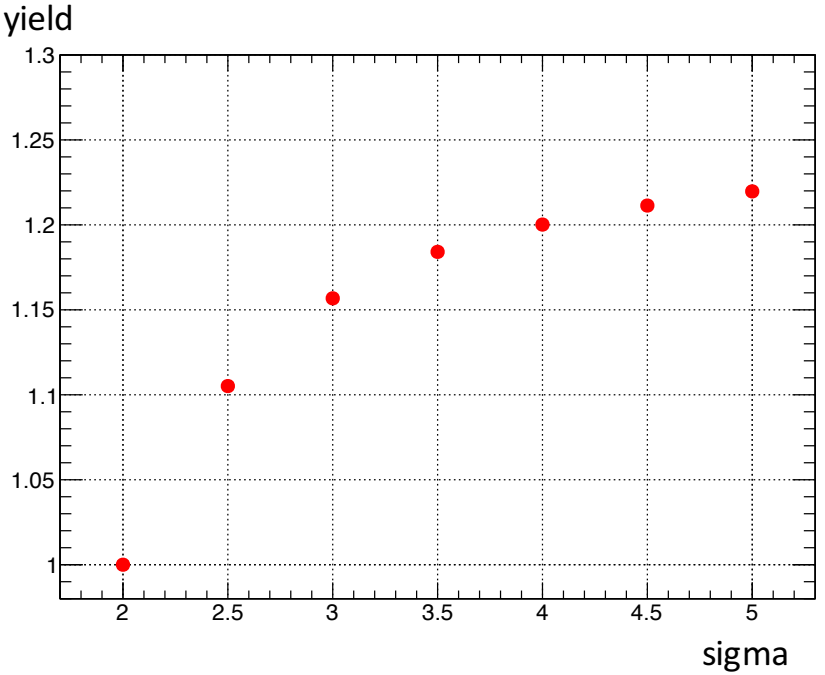


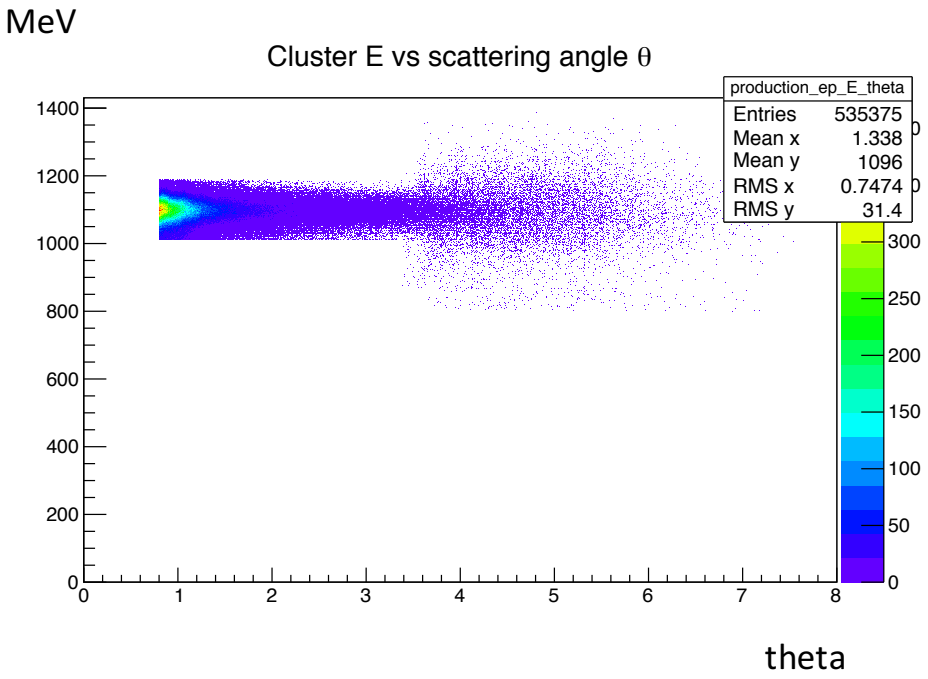


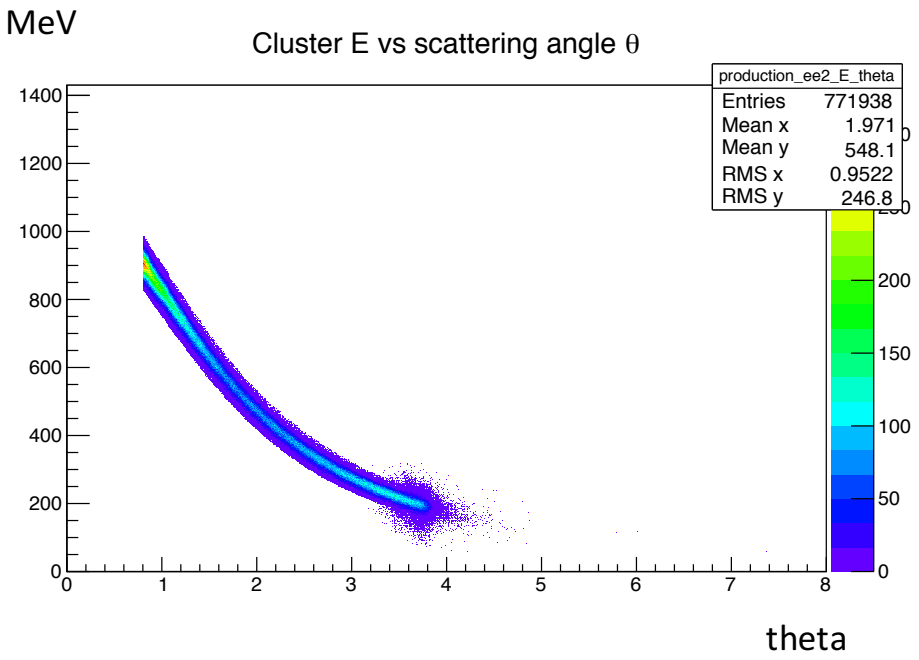
Ep and ee2 yield sensitivity to cuts

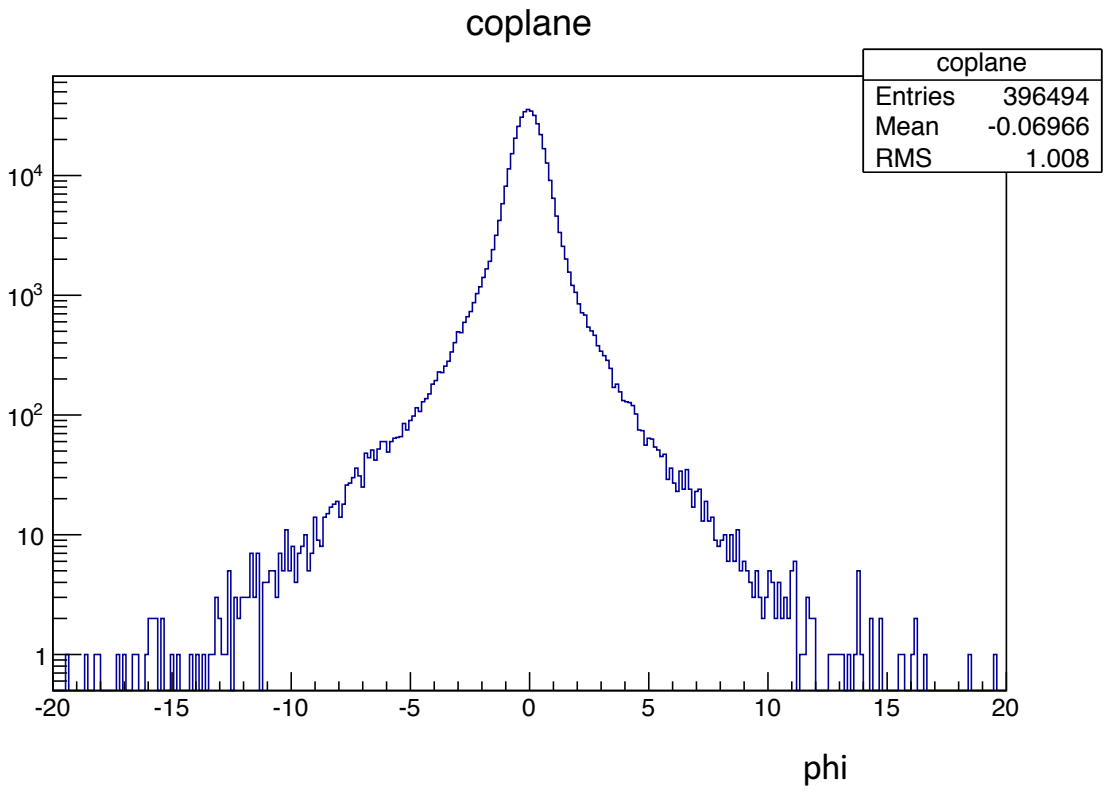
- For run 1288, change the energy cut on ep and ee2, see how to yield varies
- For ep, simply just cut around the energy, for ee2, require each electron within certain sigma of the expected energy, and the sum agree with the beam energy within certain sigma
- Yield normalized to the one with sigma = 2






MeV
Cluster E vs scattering angle θ
production_ep_E_theta
Entries 535375
Mean x 1.338
Mean y 1096
RMS x 0.7474
RMS y 31.4
theta


MeV
Cluster E vs scattering angle θ
production_ee2_E_theta
Entries 771938
Mean x 1.971
Mean y 548.1
RMS x 0.9522
RMS y 246.8
theta


coplane
coplane
Entries 396494
Mean -0.06966
RMS 1.008
10^4
10^3
10^2
10
1
-20
-15
-10
-5
0
5
10
15
20
phi